



Rootstock Research at Westfalia, South Africa

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Where is Westfalia, South Africa?





Introduction: Westfalia Ltd

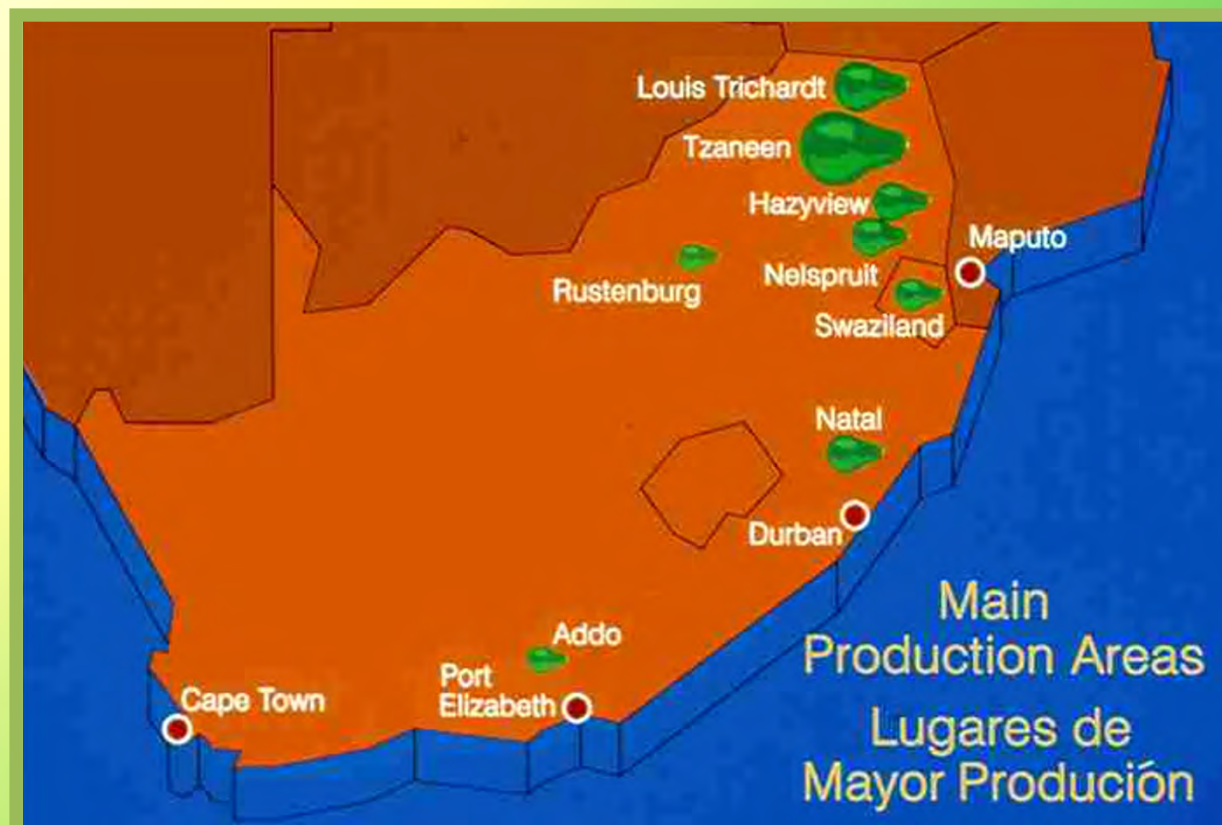
- Westfalia Fruit Estate:
 - One of largest avocado producers in South Africa
 - $\pm 1\,500$ Ha avocado ($\frac{2}{3}$ Conventional and $\frac{1}{3}$ Organic)
- Westfalia Technological Services (WTS) is the research division of Westfalia



Privately funded
(\pm USD 2 million/year)



Introduction: SA avocado industry



- 13 000 ha
- 100 000 t/year
- 50% export
- greenskins and Hass-likes



*Majority of SA avocado production occurs in high rainfall areas ($\pm 1\ 100$ mm p.a.)

Rootstock research

...from seedling
to clonal





Introduction: SA avocado industry

- Industry was initially based on **seedling rootstocks**
- By the late **1970's** the industry was almost crippled due to effect of *Phytophthora cinnamomi* (**P.c.**) root rot disease
 - Most limiting factor in avocado production in SA!
- 12 year orchard life expectancy

Unacceptable!



First clonal rootstocks in SA

- First clonal rootstocks were imported from California in 1970's
 - E.g. Duke 6, Duke 7, G755, Thomas
- After much testing South African industry soon saw the advantages of **clonal rootstocks**
 - More P.c tolerance / improved tree health
 - More uniform and productive trees
- **Duke 7** performed the best under our conditions and became the industry standard

Westfalia rootstock research



- 1980's Westfalia also started looking out for “**survivor trees**” in diseased orchards (i.e. selection process)
- 1990's Westfalia also started a **breeding program**.

Breeding Block



*Replanted 2011

Rootstock Research



- Westfalia Technological Services (**WTS**) is today the only institution in South Africa with such an active avocado rootstock breeding program
 - Our aim is to maintain high standards and to be seen as the “preferred” research collaborator
 - Collaborate** with other international parties
 - E.g. University of California (USA),
- Rootstock breeding and evaluation is a **long term process** and requires much patience and dedication.
- A successful rootstock selection will take anything between **15 and 20 years** before being released commercially

Rootstocks Research



- Important South African rootstock attributes
 - **Productivity** = higher profitability
 - **Phytophthora root rot tolerance (Pc)** / Tree health
 - Secondary attributes
 - Salinity (E.g. USA)
 - Water logged conditions / Asphyxia (E.g. Chile)
 - Productivity under replant situations
 - Cold tolerance (E.g. New Zealand)
- International collaboration** important to test these secondary attributes under field conditions.

An aerial photograph of a river meandering through a dark, forested landscape. The river's path is highly irregular, forming a series of tight, overlapping loops and curves. The surrounding terrain appears to be a dense forest with varying shades of dark green and black. The river itself is a light, silty color, contrasting sharply with the dark background. The meanders are most pronounced in the middle and lower sections of the image.

Rootstock research

Why 15-20 years?



Rootstock screening

Phase 1:

Seedlings are subjected to *P.c.* in a mistbed (6 weeks), and then retested and compared to the industry standard (Dusa[®]) = 2 years.





Rootstock screening

Phase 2:

Survivors are then put into a field trial, with high *P.c.* pressure, to test whether the trees bear well ('Hass' as scion)

= 6-8 years.



Killing fields



Healthy seedling
selections cloned

Rootstock screening

- Phase 2:
 - Annually measure:
 - tree health,
 - yield efficiency,
 - fruit size,
 - graft compatibility.



Can't afford to take short cuts.....



Rootstock screening:

Phase 3:

Successful selections are then planted on a semi-commercial scale, in various geographic areas, and compared to the industry standard. Not all trial sites have a high *P.c.* pressure

= 6-8 years.



Dusa[®] vs Duke 7

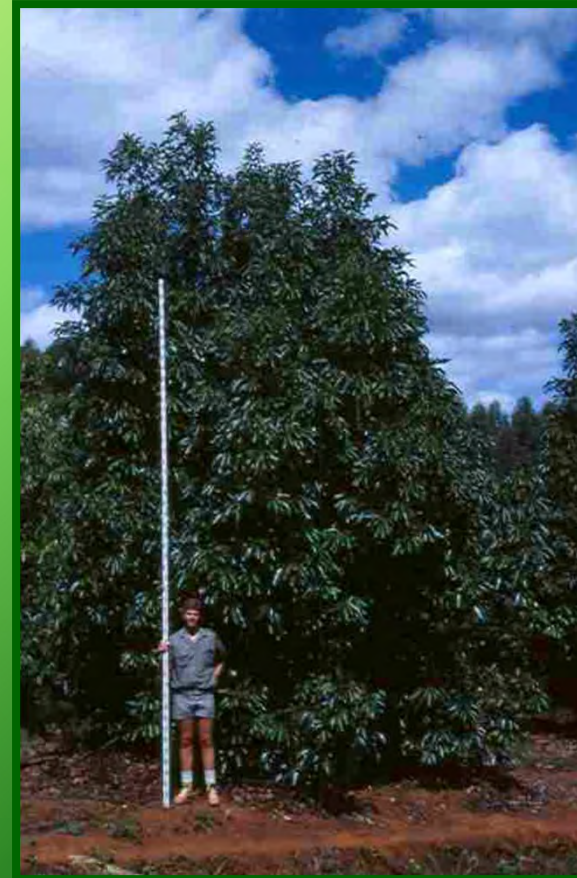
Can't afford to take short cuts....

Field testing very important



Loss of trees: Hass/Duke 6
(early 1980s)

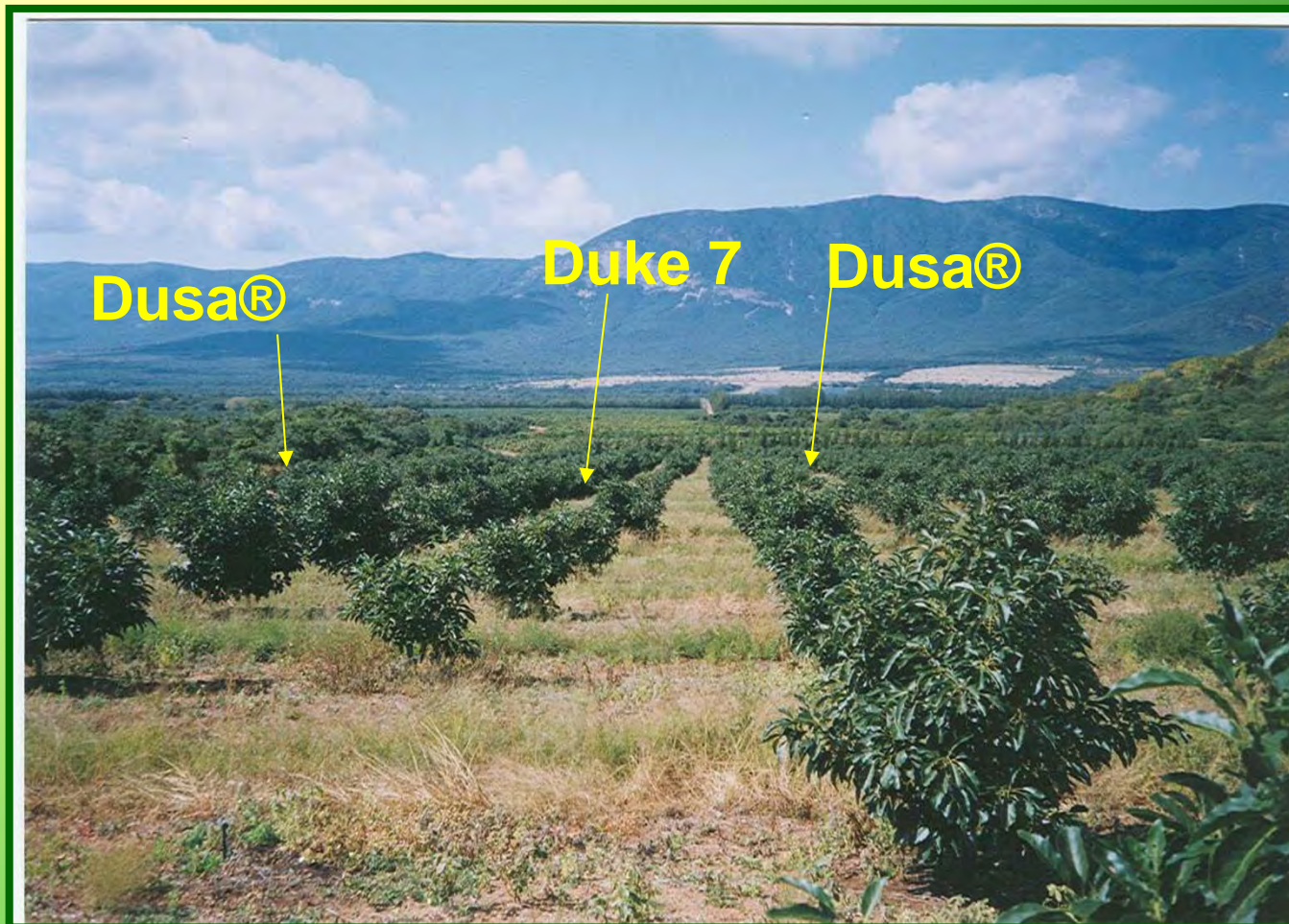
Stem pitting



Vigour: Hass/G755
(1992)

Few fruit for big tree

Westfalia's Dusa[®] followed the same rigorous testing





Where are we now?

Westfalia's Dusa[®] rootstock



- Dusa[®] has been planted commercially now for many years in different areas. Westfalia has continued to keep a close eye on tree performance compared to other commercially available rootstocks.
- So how did Dusa[®] do? Let me tell you

Commercial evaluation

Farm	Climate, soil, altitude	Rootstocks compared		
Tzaneen	Warm moist, clay soils, Alt. 800m.	Dusa [®]	Latas [®]	
Mooketsi	Hot dry, sandy loam soil, Alt. 500m.	Dusa [®]	Rootstock B	
Soekmekaar*	Cool moist, Clay loam soil, Alt. 1200m.	Dusa [®]	Duke 7	
Politsi Valley	Cool wet, Clay oxisols, Alt. 1000m.	Dusa [®]	Duke 7	
Schagen	Cool climate, sandy-clay loam Alt. 800m.	Dusa [®]	Latas [®]	Rootstock B

*Low disease pressure

Dusa[®] results from different areas



Disease pressure

- Experience to date shows that Dusa[®] out-yields Duke 7 by at least 20% in **replant** situations in SA. Dusa[®] also recommended in replant sites in California .
- Where low P.c. pressure/ virgin soil some Duke 7 trees yield just as well.
- Seedling trees not recommended and lack of tree uniformity still a problem.

Seedling vs Clonal rootstocks



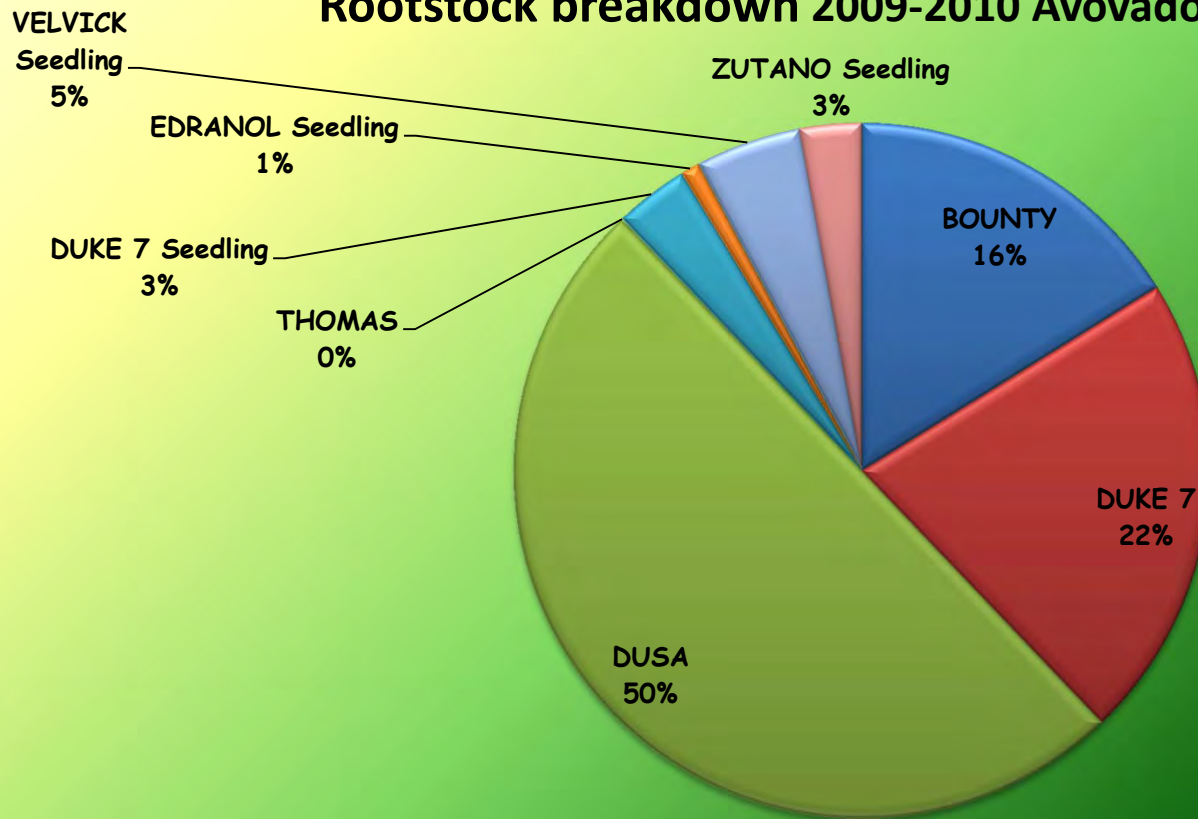
Nabal seedlings



Dusa[®] clonals

Avocado tree sales (2009-2010)

Rootstock breakdown 2009-2010 Avocado tree sales



88% Clonal (57% Dusa, 25% Duke 7, 18% Bounty)



Dusa[®] success

- Dusa[®] is our most successful rootstock to date
 - Since mid 1990's Dusa[®] took over from Duke 7 as the South African industry standard rootstock.
 - Sold across the world
 - USA, Spain, Chile, Australia, New Zealand

Grower receives 1 millionth avocado tree on Dusa[®] (2011)



International experience

New Zealand – Dusa[®] more cold tolerant

Zutano



Dusa[®]



Poor soil structure – anoxia/asphyxia?



Chile – reports so far indicate that Dusa[®] is doing well

Salt tolerance

- Trials conducted at UCR found that Dusa[®] showed relatively good salt tolerance

(Menge *et al.* 2002).

Different management

- In USA plant growth regulators such as Sunny[®] aren't registered/allowed
 - therefore tree “manipulation” different
- Same for organic orchards

Repeated girdling can lead
to yellow trees



High pH conditions

- Dusa[®] trees can become very yellow depending on management



The road ahead



A Heritage of Quality Fruit

New Rootstock Developments



- Currently have 5 new WTS rootstocks in “Phase 2” screening, with 1 new Californian rootstock. (Grafted with 6 different scion cultivars).
- First crop 2011
- **5-10 years** before commercialization!!



Rootstocks – next chapter



Procedure	Year	2011
Breeding Block : 20 rootstocks	1	Replanted 2011
Seedlings screened in Pc mistbed	2	± 7 500
10 copies / selection re-tested	4	± 5
Best selections (with Hass) planted in field trial	10	7 (planted 2011)
Pre-commercial testing	20	6 (plant 2012)
First commercial plantings producing	25	-



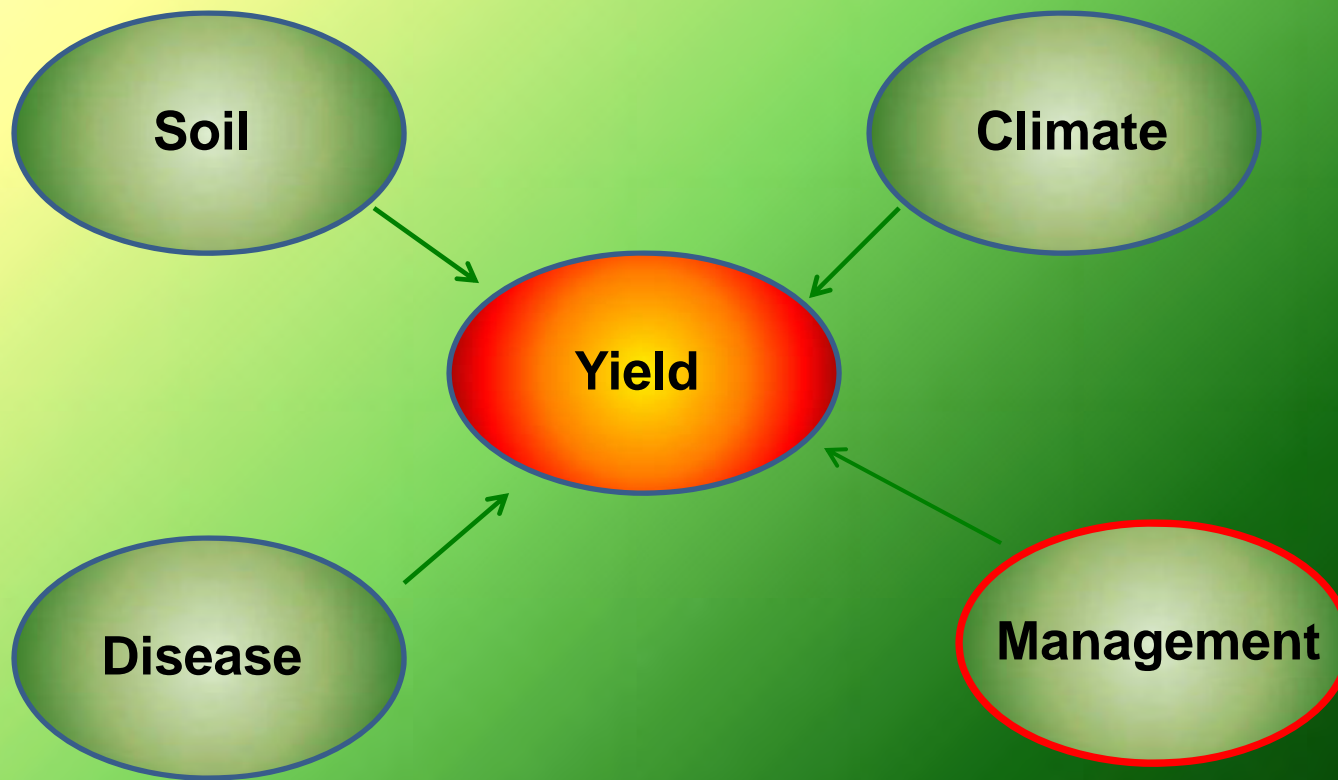


Rootstock development

- Encourage & assist in the development of clonal nurseries internationally
 - Changing preference for seedlings to clonals
- Find new rootstocks that perform better than the current selections.
- **Be assured... Westfalia has some more exciting surprises up its' sleeve!**
 - Follow our progress on www.westfaliainfo.com



What is the right rootstock for you?





Thank you – Any questions ?

